UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue
Seattle, Washington 98101

Reply To
Attn Of: ECO-088

[Date Stamped, APR 27 2000]

Lieutenant Colonel William E. Bulen, Jr., Commander
Department of the Army
Walla Walla District
U. S. Army Corps of Engineers
201 North Third Avenue
Walla Walla, Washington 99362-1876

Dear Lieutenant Colonel Bulen:

The U.S. Environmental Protection Agency (EPA) has reviewed the **Lower Snake River Juvenile Salmon Migration Draft Feasibility Report and Environmental Impact Statement** (DEIS). This report looks at four alternatives to improve passage of juvenile salmon through the four lower Snake River dams and the technical, environmental, and economic impacts of each of the alternatives. Our review was done in accordance with our responsibilities under the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act (CAA). CAA Section 309, independent of NEPA, specifically directs EPA to review and comment in writing on the environmental impacts associated with all major federal actions.

EPA is a cooperating agency for this DEIS. We have corresponded with the U.S. Army Corps of Engineers (Corps) on numerous occasions since 1996 relaying our water quality and air quality concerns. We have worked closely with the Corps in the National Marine Fisheries Service/Endangered Species Act Forum, the Federal Caucus and the All-H Process. Further, we are currently working with the Corps to develop a water quality strategy for the 2000 Federal Columbia River Power System Biological Opinion. We know that solving water quality problems in the Federal Columbia River Power System is a very difficult task and we are committed to working closely with the Corps on this issue. In that regard, our key staff met on April 21, 2000, to discuss EPA's issues with the DEIS and to develop a process for resolving those concerns. We reached agreement on the need to clarify the impact of the existing dams on water quality. We assigned a workgroup of technical staff from both of our agencies to conduct a joint water quality analysis to be included in the next version of the EIS. We also agreed to work together on air quality, economics and the other issues EPA has raised, in order to resolve them for publication of the EIS.

EPA's primary goal in the Columbia Basin is to improve water quality for ecosystem recovery by ensuring that federal dams are operated in a manner that results in attainment of state water quality standards. This is consistent with our trust responsibility to Columbia River Tribes.

Based upon our review, we have rated the DEIS, 3 (Inadequate). Our review determined that the DEIS does not adequately assess the potentially significant environmental impacts of all the alternatives. Specifically, the DEIS:

- improperly evaluates the water quality impacts of alternatives 1 through 4;
- does not include a strategy to comply with water quality standards;
- does not include the costs of achieving water quality standards under alternatives 1 through 3 in the economic analysis; and
- does not adequately evaluate the air quality impacts of any of the alternatives.

Since there was no preferred alternative, we rated the environmental impact of each alternative. We rated Alternatives 1, 2 and 3 as EU (Environmentally Unsatisfactory). We rated Alternative 4 as EC (Environmental Concerns). These ratings reflect the scope of this EIS process: hydropower impacts to the lower Snake River salmon stocks. The EIS process is only one part of a broader Regional process to determine the best strategy for salmon recovery across the Columbia Basin. The final decision on the lower Snake River dams will come from that broader process. The ratings are based on the fact that alternatives 1-3 will continue the current water quality standard exceedances and Alternative 4 is the only alternative presented in the DEIS that will likely result in attainment of WQS in at least the mid-term. Attached is an explanation of the EPA rating system and our detailed comments. This rating and a summary of these comments will be published in the Federal Register.

The DEIS does not adequately characterize the impacts of the existing dams on water quality. We are particularly concerned with the DEIS' treatment of temperature. The document concludes that the lower Snake River dams actually lower water temperature in the impoundments. We believe that this conclusion results from selective use of data and selective use of modeling results. EPA water temperature modeling clearly demonstrates that the dams cause water quality standard exceedances almost on a daily basis during the hot part of the summer by inhibiting the diurnal water temperature fluctuations that occur under free flowing conditions. Dams also delay or even preclude the water cooling effects of cool weather caused by weather fronts or changing seasons, leading to numerous days of exceedance of the water quality standard. The attached comments explain our analysis of temperature in detail and also address the impacts of dams on total dissolved gas (TDG) and dissolved oxygen (DO). The DEIS understates the impacts of the dams on TDG and does not discuss nonattainment of the DO standard, although those exceedances are revealed in data presented in Appendix C.

The EIS must acknowledge the effects of the existing dams on water quality. Water quality impacts are particularly important because they pertain directly to the biological requirements of the fish that the feasibility study is intended to address. Attainment of water quality standards should be a major factor in selection of the preferred alternative because of the biological requirements of the fish and the objectives of the CWA.

Based on our review, we do not believe that the DEIS is adequate for the purposes of NEPA. The major deficiency is that the water quality impacts of Alternatives 1, 2 and 3 are not adequately characterized and no strategy is presented to mitigate those impacts. I look forward to working with you to address the issues raised in this letter. However, if we are unable to resolve our concerns, this matter may become a potential candidate for referral to the Council on Environmental Quality for resolution. It is essential for the EIS to discuss all of the environmental impacts of all of the alternatives. Please call me at (206) 553-1234 to discuss these comments or have your staff contact Richard Parkin at (206) 553-8574.

Sincerely,

[Signature]

Chuck Clarke
Regional Administrator

Enclosure

Detailed Comments from the US Environmental Protection Agency on the
Lower Snake River Juvenile Salmon Migration Feasibility
Draft Report/Environmental Impact Statement

WATER QUALITY

The draft EIS does not adequately acknowledge the impacts of the existing dams on DO and water temperature. It is essential for the EIS to discuss all of the environmental impacts of all of the alternatives. Water quality impacts are particularly important because they pertain directly to the biological requirements of the fish that the feasibility study is intended to address. Attainment of water quality standards must be a major factor in selection of the preferred alternative because of the biological requirements of the fish and the objectives of the CWA.

Water Temperature

The draft EIS indicates that dams actually result in cooler water temperatures in the impounded system than in the free flowing river. It implies that water temperature conditions for salmon have improved since the dams have been put in place. The discussion supporting this hypothesis is flawed and misleading. Structural flaws in the analysis and presentation are of the following kinds:

- Does not interpret or resolve contradictory data and conclusions
- Selective use of data
- Methods used have not been peer reviewed
- Faulty or misleading interpretation of results
- Failure to present important information or assumptions
- Unsupported conclusions

One of the confusions the reader must deal with is caused by a myriad of water temperature models, some of which are very similar but appear to suggest different outcomes. The draft EIS refers to five models. They are: (1) linear model in Appendix C that is based on observed data; (2) Systems Operation Review (SOR) model; (3) WQRRS model applied by Normandeau and Associates (1999); (4) the MASS1 (called the MASS2 model in the draft EIS) developed and applied by Perkins and Richmond (1999) of Battelle Northwest; and (5) RBM10 (referred to as the EPA model in the draft EIS)(Yearsley, 1999). The draft EIS does not discuss the strengths and weaknesses of the models, compare them, judge their suitability for this effort or synthesize the results into a conclusion on the effect of the dams on water temperature. In the end, the draft EIS doesn't appear to rely on the results of the models but instead seems to give more emphasis to examination of historical data. In the following sections we evaluate the conclusions in the draft EIS regarding the effects of the dams on water temperature.

Would the free flowing river be warmer than the existing series of impoundments?

The document concludes, “The data show that the river was warmer than the existing series of reservoirs.” (p. 5.3-6) This statement is based on “historical data presented in Technical Appendix C....” (p. 5.3-6) The only historical data in Appendix C for water temperature from the river before the dams were constructed is data from 1970 and 1971 for the Lower Granite area before Lower Granite Dam was constructed but all of the other dams were in service at that time. The referenced conclusion above is weak since it relies only on 2 years of data and is pertinent only to Lower Granite Dam. Further, the maximum water temperatures shown from that station are in the range of 23 to 24 degrees centigrade. After the Lower Granite Dam was built, water temperature commonly reached 23 degrees and on occasions ranged two and a half degrees higher (Table 3.2, Appendix C). Based on data from Appendix C, it does not appear that water temperature has cooled since the Lower Granite Dam was built.

Has there been a general lowering of water temperature since the dams were constructed?

The document further concludes, “The data the Corps has published since the dams became operational show a general lowering of water temperature at the reservoirs, and a more dramatic decrease since 1992 when cool water releases at Dworshak began.” (p. 5.3-6) This conclusion is actually discussed at some length in Appendix C where a linear model is constructed. Before evaluating that linear model, we will take a look at the data on which this conclusion is based.

The data used in this analysis are the scroll case data. The draft EIS reports that these data were used based on an unreferenced agreement made with fisheries agencies. So far as we know, none of the water temperature data from the Snake and Columbia have been developed with a quality assurance/quality control plan. The scroll case data are imprecise. The measurement is made daily by eye from a thermometer attached to the turbine scroll case. It measures the temperature of the water entering the generating turbines of the dam. The Corps also measures and reports water temperatures associated with the Total Dissolved Gas project. These temperatures are measured electronically in both the forebay and tailrace of the projects and reported on the DART site. A random sampling of the two types of measurements is shown in the attached Figure 1. Two features of the scroll case data are revealed in the graph and are typical of the larger record. One feature is that the scroll case data remains constant for days and changes in a step fashion. The other feature is that the data shows water temperature is consistently lower than measurements made at the TDG stations. No explanation is given as to why the scroll case data is selected over the TDG station data. If TDG station data were selected one would arrive at a different conclusion; that water temperature has not been lowered since the dams were constructed.

The general linear model used for this analysis is based on the hypothesis that there is some process leading to an increase (or decrease) in some condition, but that there is also some uncertainty or variability (randomness) that cannot be accounted for by the linear or deterministic portion. A fundamental assumption is that both the random portion and the deterministic portion are stationary in the sense that there are no major interventions that might affect the basic hypothesis. In the case of the water temperature in the lower Snake River, this hypothesis might be that all the factors affecting water temperature (meteorology, hydrology, system operation) were leading to increases or decreases in water temperature with time. Other hypotheses might be that individual elements, such as meteorology alone, hydrology alone, or the dams alone would be leading to an increase or decrease in water temperature with time. The draft EIS never states what the working hypothesis is, but Appendix C states, “The general impression from these data is that maximum water temperatures have gone down since the reservoirs were created..” This implies that it is the existence of the dams that is leading to a decreasing trend in water temperature. This “general impression” is supported by a series of figures showing a regression of maximum water temperature versus time. The slope of the line in all figures is downward, implying cooling, but no significance or statistical analysis is presented.

We conducted the same analysis using water temperature data from the TDG stations for the last 20 years as shown in Figures 2 and 3. The maximum water temperatures are higher than those reported in the draft EIS. Furthermore, the variance explained by the analysis is only 19% at Lower Granite Dam and less than 1% at Ice Harbor Dam. The slope of the line is significant at the 95% level at Lower Granite Dam, but this most certainly has more to do with the operation of Dworshak Dam than it does with the existence of Lower Granite Dam. The slope of the line is not significant at the 95% level at Ice Harbor Dam. We see no basis to hypothesize that a series of dams will lead to decreases in water temperature over time by simply being there.

Has the number of days in a year that water temperature exceeds 68EF decreased since the dams were constructed?

The final conclusion of the water temperature effects section of the draft EIS is, “According to the Corps’ measured data, the number of days exceeding 68EF has decreased since the reservoirs were developed.” Again the data in Appendix C for prior to dam construction only pertains to Lower Granite Dam, and the data for the period since the dams were constructed is the scroll case data which appears to read on the low side as compared to the TDG station measurements. We examined this issue using the water temperature data from the TDG stations. These data are from 15 feet deep and the reservoirs do not stratify (draft EIS p. 4.4-5). Figure 1 shows that the TDG stations revealed about 9 days during July 1999 during which 68EF (20EC) was exceeded, while the scroll case data showed no days of exceedance. Table 1 compares the number of days of exceedance at Ice Harbor and Lower Granite Dams measured at the scroll case and at the TDG stations. Table 1 shows that the TDG stations had many more days of exceedance, which puts the conclusion in doubt. The choice of water temperature data used will influence the conclusion.

The attached Figures 4, 5, and 6 are reproduced from the report, “Lower Snake River

Temperature and Biological Productivity Modeling" (Normandeau and Associates, 1999). These figures contain water temperature data from two stations on the Snake River prior to construction of the dams. The Central Ferry station was at river mile 83.2 and the Sacajawea station was at the mouth of the river. The squares on the graphs are actual observed water temperature values. There is no information given on how or where in the river cross section the measurements were taken, but they represent data for comparing the number of days that water temperature exceeded 68EF before and after construction of the dams. By inspection from those graphs, we made the following estimates of number of days per year with exceedances of 68EF.

Central Ferry, 1956	- 64 days over 68EF
Sacajawea, 1956	- 66 days over 68EF
Central Ferry, 1957	- 85 days over 68EF

Comparison of these data to Table 1 (attached) does not support the conclusion that the number of days in a year that water temperature exceeds 68EF have decreased since the dams were constructed. Over the 20 year period, the scroll case data has 3 years at each dam with 64 or more days of exceedance. The TDG Station data had 12 years with 64 or more days of exceedance at Ice Harbor Dam and 7 years at Lower Granite Dam. There were 5 years with exceedances in more than 83 days at Ice Harbor Dam and 2 years over 85 days at Lower Granite Dam.

In summary, we don't think there is any merit in the conclusions in the EIS resulting from inspection of historical scroll case data. These data are of questionable quality and not representative of the entire data base. The purpose of the mathematical modeling is to provide some understanding of the effects of the dams on temperature to augment what can be learned from examination of the data.

Evaluation of the four models

From the information available on the four models described in the draft EIS, it appears that only the RBM10 analysis conducted by EPA was peer reviewed or made any effort to evaluate the quality of the existing data and factor that quality into the analysis. A statistical analysis of the difference between observed and simulated values shows that the RBM10 model, on the average, slightly under predicted water temperatures at most locations under existing conditions. No data were available to make this comparison for the natural (unimpounded) river.

The SOR model described in the draft EIS is difficult to relate to this discussion because it models a different threshold water temperature and, at least from the discussion in the draft EIS, does not report values for alternative 4.

We reviewed the draft model report of the WQRRS mathematical model by Normandeau and Associates (1999) and commented extensively to the Corps. We have not seen the final report describing this work. The application as described in the draft had several problems. There was little discussion of model uncertainty. Conclusions reached by the analysts were based on the comparison of predicted normative (natural) conditions with observed existing conditions. Conclusions that breaching the dams would result in higher peak water temperatures than the existing impoundments (draft EIS, p. 5.3-7) are based on modeling results from 1994 when massive amounts of cold water were released from Dworshak. In the other years presented in the analysis (1995 and 1997) existing water temperatures were greater than predicted temperatures after breaching except during 1997 at River Miles 44.15 and 15.94. This report did not show the TDG data, either, which generally seemed to be higher than the results reported by Normandeau and Associates (1999). Again selective use of data and of modeling results leads to the conclusions in the draft EIS that this model predicts higher water temperatures during low flow years under Alternative 4 (Breaching) than the other alternatives.

MASS1 is a one-dimensional model developed by Battelle Northwest (Perkins and Richmond, 1999). It has been used primarily to simulate total dissolved gas in the lower Snake River, but its water temperature simulation algorithm is similar to that of WQRRS and RBM10. The report provides minimal comparison of model predictions and observed data. Simulated values of maximum water temperatures are consistently lower than observed temperatures by 1-2 ^{o}C. MASS1 predicted water temperatures at time intervals of 1.5 minutes. It is important to note, though not reported in the draft EIS, that Perkins and Richmond (1999) chose the water temperature predicted at 3:00 PM each day as the one that was representative of the daily water temperature. The water temperature at 3:00 PM is probably very often close to the maximum water temperature of the day. The natural river will have greater daily fluctuations than the impounded river, so that the results reported by Battelle in their analysis will be higher, but not necessarily inconsistent with results from a model, such as RBM10, that simulated daily averages.

The draft EIS briefly discusses a model by Bennett et al. (1997). This model apparently concluded that, “maximum temperatures during the summer months of July through August are anticipated to be approximately 3.6E to 9.0EF [2E to 5EC] higher under Alternative 4 - Dam Breaching, approaching 78.8E to 80.6EF [26E to 27EC].” (draft EIS, p. 5.3-7) We have no information about this model or how it was applied or what data were used. However, it appears that this conclusion is again based on scroll case data for the existing condition. When TDG station data are compared to the Central Ferry and Sacajawea data from 1956, 1957 and 1958, the differences are not so great.

Maximum Water Temperatures

	1956	1957	1958
Central Ferry	~26EC	~24.5EC	insufficient data

Sacajawea	~24EC	~26EC	~ 26.5EC

Our Figures 2 and 3 show that TDG Station water temperature data commonly exceeds 24EC and has been recorded as high as 26EC

The RBM10, WQRRS, and MASS1 are all similar and indeed, the results of the three are similar. Differences in the results can be attributed to the data used, the water years simulated and the methods of expressing results. We re-ran the RBM10 model to express the results in a manner more consistent with WQRRS and also to show the diurnal water temperature fluctuations that would occur in the free flowing river and the system of impoundments. Figure 7 represents an RBM10 simulation of 1994. Figure 8 taken from Normandeau and Associates is a WQRRS simulation for the same year. Though the scales are a little different on the two graphs, the similarities in the predictions are readily obvious. The jagged variations in Figure 7 represent the diurnal fluctuation in the system. Figure 8 only simulates the daily maximums so it does not have the variations.

Water Quality Standards Exceedances

The models reveal a number of effects of the dams on water temperature. The dams have resulted in a significant change in the energy budget of the lower Snake River. The instantaneous daily water temperatures may be greater under some conditions in the natural river than in the impounded river, but high water temperatures in the natural river don't last as long seasonally as the high water temperatures in the impounded river. Furthermore, the maximum water temperatures in the natural river are accompanied by equally larger diurnal fluctuations resulting in lower water temperatures in the evening. Figures 9 through 14 are a series of simulations from RBM10 that show water temperature for the free flowing river and the impoundments for 1977, 1980 and 1990.

They clearly illustrate that though the free flowing river can have higher daily maxima under some conditions, it frequently doesn't. They also show the daily fluctuation in the natural river cools it by as much as 1.5 degrees C and the impoundments stay warm much longer into the late summer and fall. The Washington State water quality standards for temperature in the lower Snake River prohibit temperatures above 68EF due to human activities. It is important to note that in so far as the dams are a human activity, an exceedance of the water quality standard occurs whenever the present conditions curve in the figures is above 20EC and above the unimpounded curve. The figures reveal numerous, significant water quality standard exceedances caused by the dams.

Significance of High Water Temperature on Salmon

The EIS should highlight the important relationship of cool water temperature and meeting the various life history and life stage requirements of salmon. Other than stating that, "Salmonids ...appear to be the most sensitive to water temperatures...", very little else is said about the effect that temperature has on juvenile and adult salmon survival. The EIS should explain the overall role water temperature plays in the ecology and physiology of salmon, and its significance among the other factors reducing their survival and recovery potential. This oversight is a significant flaw in the current draft EIS, and should be rectified in the revised draft EIS.

During freshwater life history stages, the water temperatures to which juvenile and adult salmon are exposed are among the most significant determinants of both individual viability and stock survival and recovery (Coutant 1999, McCoullough 1999). The EIS needs to discuss the direct effects of high water temperature on the adult salmon and consequently, how a stressed adult negatively impacts fecundity, viability of embryos, hatching success, and survival of emerging fry.

Although the title of the draft EIS suggests that dam operations and juvenile salmon migration feasibility are the appropriate scope of concern, the crux of the issues surrounding this discussion are really about the role that the lower Snake River dams play in the long term survival and recovery of native salmon stocks. Passage of juvenile (and we argue, adult) salmon above and below these four Corps dams needs to be described in a more encompassing way, that includes consideration of the ecological and physiological consequences to salmon of conditions imposed by the dams vs. those experienced if the lower Snake River were returned to a free flowing state.

Temperature Dynamics in a Free Flow Versus Slack Water Regime

The draft EIS states (p. 4.4-14) that prior to dams the Snake River experienced seasonal water temperature exceedances of 22EC. While this may be true, it is also highly misleading since no discussion or context is given for this assertion. It is misleading to compare the water quality of two different aquatic systems based solely on instantaneous maximum water temperature measurements. The EIS needs to describe and compare the water temperature regime characteristics of these two entirely different systems - one, a free flowing system with variable diurnal and seasonal water temperature characteristics and the other a slack-water system with more limited diurnal water temperature fluctuations. In Appendix M of the DEIS, the Fish and Wildlife Service specifically noted that “Water temperature regimes would improve with a riverine system.” This perspective does not seem to be reflected in the DEIS itself.

A discussion of diurnal and seasonal water temperature regime characteristics from one of the Snake River tributaries should be used to illustrate these differences. River temperatures may warm quickly in response to daily air temperatures, but they will also cool quickly in the evening. In a natural river state, tributary confluences, seeps and springs, and points of upwelling from hyporehic and ground water input sources bring sources of cool water to the main river. Over time, salmon have evolved in response to these more natural conditions. Other instream and riparian compensatory factors help salmon cope with seasonal and daily periods of elevated stream temperatures. These factors have been thoroughly described in a number of recent publications (Coutant 1999, McCoullough 1999, ISG 1996) and should be thoroughly described in the final EIS.

The draft EIS (p. 4.4-14) states that, “the greater residence time in the reservoirs causes surface waters to warm up faster and also to cool down more slowly.” This begs the question, to what temperature does the surface water rise and, if above the standard, for how long does the temperature stay above the standard before cooling down. The consequences this has on adult and migratory juvenile salmon, and their predators, should be described in detail. This is an essential distinction between poor and good salmon habitat in terms of water temperature, and without this discussion, the reader has no legitimate basis to judge the merits of the alternatives considered.

Of the water temperature data presented, the EIS should explain how measurements are made, data collated and summarized, where they are taken, and how representative they are of the surrounding waterbody. Explain if the water temperature measuring protocols used today are the same as used before the dams. Comparisons among instantaneous, spot water temperature data for a given day may be highly dubious, given that water temperatures can vary significantly given, simply, the time of day. Explain if water temperature measurements are being taken in the same place as they were before the dams, and how the instruments were calibrated. Characterize in the EIS the frequency, magnitude, and duration of the water temperature exceedances in the river both before and after construction of the four dam complex on the lower Snake River.

Dissolved Oxygen

The draft EIS does not discuss data from Appendix C that indicate that significant exceedances of the water quality standard for DO occur in the reservoirs of the impounded system. The Washington standard for oxygen that is applicable to the lower Snake River is 8.0 mg/l. Concentrations of DO as low as 2.3 mg/l were measured at the bottom of Lower Granite Reservoir. Even at the surface of the reservoir, DO concentrations appear to be below the 8.0 mg/l standard. At Little Goose Reservoir, DO was 4.7 mg/l at 30 meters, 5.5 mg/l at 10 meters and as low as 7.2 mg/l between 0 and 10 meters. No discussion of DO concentrations in the other two reservoirs was provided. The draft EIS does not bring any of this information up from Appendix C.

The DEIS does not discuss the relationships of DO to temperature in a holistic ecosystem context. For example, water temperature and DO stresses magnify each other. Warm water temperatures increase the fish’s metabolic rate, requiring more oxygen. If oxygen levels are depleted significantly below saturation levels it is less available to the fish. Further, under the natural river conditions cool water refugia where ground water entered the system were available to fish near the bottom of the river. Low DO levels may make those refugia unavailable to the fish.

The draft EIS does not cite the continued exceedance of DO standards as an impact of Alternatives 1, 2, and 3. Nor does it explain that Alternative 4 would reduce, if not eliminate, exceedances of the DO standards and related stresses in the lower Snake River system.

Sediment

In describing the dam breaching alternative, the draft EIS brings up a number of issues associated with consequent release of the accumulated sediments behind each of the four Lower Snake River dams. These issues include: (1) input and transport of sediments, (2) duration and magnitude of water quality exceedances for turbidity above background levels, (3) ecological consequences on salmon of the release of these sediment, and (4) contaminated sediments and the consequences of their release.

Issue #1 - Input and transport of sediments -

Appendix F of the report provides information on hydrology, hydraulics and sedimentation, and addresses issue number one directly. Since completion of the Ice Harbor facility in 1962, an estimated 76.5 - 114.7 million cubic meters (100 - 150 million cubic yards) of sediments have accumulated behind the four lower dams. The annual sediment budget is estimated at 3 - 4 million cubic yards per year (p. 3-4). The input and routing of sediments to rivers such as the Snake is a natural function resulting from ongoing erosion of hillslope sediments. These sediments represent a portion that can be considered natural background levels, and an additional portion that results from erosion triggered by land uses, accumulated over the 40 years of project life. Since construction of the lower river projects, input and transport of background levels of sediment have been blocked by the reservoirs. Available data suggests that 50% of the sediment particle sizes are 5.7 mm (2 inches) in diameter or greater. Not all of these sediments will be entrained and moved downstream, however. Although no specific analysis was prepared for the Snake River dam breaching alternative, model results of sediment erosion rates prepared for the Elwha Dam removal analysis suggests “that 15-35% of the coarse sediments and about half of the fine sediment would be eroded from the two reservoirs” currently blocking that river (DOI, 1966). Accumulated sediments within the wetted width of seasonal high flows will be subject to entrainment and transport downstream during the first few years following dam breaching.

If released, the bulk of the primarily fine grained sediments that are entrained will move downstream to collect behind the reservoir created by McNary Dam, with most of this material moving within the first few years after dam breaching. Others will be re-worked by the river to form bars as the river flow conforms and re-establishes its historic channel configuration. Within 5 to 15 years, salmon habitat features such as riffles, pools and glides will form, and banks will become re-vegetated and stabilized. The draft EIS states that equilibrium conditions for sediment transport and deposition will return to natural levels in two to five years. Appendix H, which describes the fluvial geomorphology aspects of the dam breaching alternative, provides more substantial detail on pre-dam river characteristics, processes, and salmon spawning and rearing habitat distributions. Appendix H also provides estimates of the quantity of salmon spawning and rearing habitat and their links to flow regimes, critical velocities and sediment transport capacity. For example, there would be more than an order of magnitude increase in chinook spawning habitat in the un-impounded river versus the impounded condition (est. 3521 acres vs. 226 acres). A summary of these findings should be added to the executive summary of the final EIS to better describe the possible outcomes of restoration of the historic river channel to meeting the spawning and rearing requirements of listed salmonid stocks.

Issue # 2. Water Quality and Turbidity

The draft EIS discusses the turbidity and Total Suspended Solids (TSS), which are water quality concerns associated with dam breaching and draw down. The report describes in general, the range of possible negative effects on aquatic biota and productivity. The information presented is confusing and doesn't adequately convey the relative significance of likely water quality exceedances associated with the dam breaching and draw down alternative. The report states that with breaching, the frequency with which TSS would exceed threshold levels (est. at 25mg/l) is approximately 36% (131 days), and 25% (91 days) over the next 15 years. Yet, no context is provided to understand how this might compare with pre-dam background levels, nor over what particular assumptions of flow magnitude or precipitation patterns are used in generating these estimates. This information should be better integrated with the hydrology, geomorphology, and sediment data provided in the appendices. Undoubtedly, the Snake River historically experienced frequent and sustained exceedances of this TSS threshold during seasonal storms and runoff events. Comparing it to existing reservoir conditions is not as informative as understanding how these short term exceedances compare with pre-dam conditions. This information should be provided. Also, a better explanation of the timing of these events and how they overlap with both downstream juvenile migration and upstream adult migration would be helpful. Also, it would be useful to describe what opportunities exist for mitigating these impacts by controlling the rate and timing of draw down. Making reference to where this information is located elsewhere in the draft EIS would be a helpful guide for the reader.

Issue # 3. Consequences on salmon of the release of these sediments.

The draft EIS discusses in some detail the attendant affects of dam breaching and sediment releases on salmon (pp. 5.4-33 to 35). The description of the short-term effects of dam breaching includes the statement that "riprap would be placed along about 25% of what would be the future shoreline, thus altering shoreline characteristics." It is not clear if this statement is literally true or the bank hardening would only occur near each of the dams to facilitate stability during breaching. If the former, more details need to be provided since this practice could significantly affect the recovery of river channel characteristics.

The discussion of suspended sediment effects (pp. 5.4-34 to 35) is informative, but not conclusive. There appears to be both negative and positive effects possible, and there is no certain way to quantify either. The duration of the short term effects of increased turbidity seem to extend for the first few years after dam breaching. Compensatory factors associated with restoration of the river to a free flowing condition may mitigate for the otherwise negative effects of juvenile fish exposure to high turbidity levels. The short-term effects of turbidity and sediment moving downstream would likely be most detrimental to rearing fall chinook salmon, since this stock spends up to four months rearing in the mainstem lower Snake River. Scientists are uncertain if this long-term rearing phase is natural or induced by this stock having no alternative to the reservoir environment. So, it is possible that once given free access, these fish may migrate downstream in the spring to rear in the Columbia River proper.

Issue # 4. Contaminated sediments

We are concerned about re-entrainment in the water of contaminated sediment should the dams be breached. On page 5.3-3, the draft EIS identifies manganese, dioxin toxic equivalency quotient (TEQ), and total DDT as three contaminants of concern. We are aware that there are more than just these three contaminants in the sediment and this should be disclosed as well. The concern is that the re-entrained contaminants would become biologically available. However, on page 5.3-8 this concern is dismissed because the two organic contaminants of concern are predicted to be in concentrations below the thresholds permitted by present sediment quality criteria and because manganese would remain below levels of toxicity or health effects. We have noted that while the concern of toxic sediment is stated in the summary, the conclusion is not. It would be useful to state this finding up-front, so that the casual reader is given the conclusion in the summary.

In spite of the conclusion, we remain concerned about the re-entrainment of contaminated sediment under Alternative 4. The EIS would be improved by explaining the threshold levels and what they are intending to protect (human or animal health), what the contaminant levels are now, and what they would be if the dams were breached.

Rather than simply stating that high levels of suspended sediments may pose a problem for juvenile salmonids, it would be helpful if the Corps could attempt to quantify the relative effect of these possible sediments. Using an assessment approach, such as described by Newcombe and Jensen (1996) might clarify the relative, if not the actual, level of risk to stocks of concern. Presenting this assessment under a best, moderate and worst case projections of duration and magnitude of TSS thresholds would provide the reader a more realistic basis to judge the merits of the proposed alternatives, in the context of pre-dam levels of seasonal elevated sediment loads.

Total Dissolved Gases

State in the Summary that the lower Snake River is listed under Section 303(d) of the Clean Water Act as not meeting the water quality standard for TDG.

The draft EIS seems to imply on p. 4.4-10 that the lower Snake River is now meeting water quality standards for TDG although it is listed under Section 303(d) of the CWA. The draft EIS states that high saturation concentrations only occur during high flow events and later states that TDG criteria do not apply when the stream flow exceeds the 7-day, 10-year frequency flood. While the state standards make provision for high flows, the existing biota will still be subject to dangerous levels of TDG. The DEIS should clarify that Alternative 4 would eliminate this risk. Also, on p. 5.4-44 under Aquatics, the draft EIS states that, “Current saturations are not considered to be causing mortalities.” This statement should be substantiated. How do you know this? Also, explain that direct mortality is only 1 effect of TDG. High TDG levels add to the stress of juvenile and adult salmon already significantly stressed by conversion of their riverine ecosystem to impoundments, passage through dams, fish handling, barging, etc.

AIR QUALITY

Incomplete Air Quality Analysis

The analyses presented in Section 5.2 of the draft EIS and Appendix P focus exclusively on comparing estimated air emissions from project-related activities in the lower Snake River region. Comparing air emissions is not the best way to determine impact to air quality as there is no context for these numbers. Instead, a second step is needed to compare against air quality standards for criteria pollutants or some reduction goals in the case of Greenhouse Gases.

With respect to criteria pollutants, the emissions estimates should be translated to ambient air concentration estimates and compared against established ambient air quality standards. This is typically done using dispersion modeling techniques. The EPA has National Ambient Air Quality Standards (NAAQS) for criteria pollutants which can be used for comparison. In addition, EPA has a program for Prevention of Significant Deterioration (PSD), which is designed to prevent the slow decline of air quality in areas with clean air to the NAAQS. Changes in ambient air concentrations of a pollutant should be compared to increments that have been established in the PSD program.

In the case of greenhouse gas (GHG) emissions, the projected emissions should be evaluated in the context of whether they would be consistent with or jeopardize achieving established GHG reduction goals, and they should be compared with regional, national, and global GHG emissions and reduction goals.

We recommend that the EIS be revised to include these analyses.

Preliminary EPA Comments Not Incorporated into Draft EIS

The information/analyses presented in Section 5.2 of the draft EIS and Appendix P does not reflect many of the elements contained or discussed in Delivery Order No. 14, the work plan prepared for the air work, our comments on the work plan, or our comments on two draft versions of Appendix P. We refer the Corps to the following correspondence which contains many comments which we believe are still relevant and should be addressed in the EIS:

1) *Comment letter on Work Plan [Ryan (EPA) to Sedgwick (Corps), 12/22/98]*
2) *Comment letter on Preliminary Draft of Appendix P [Parkin to Mettler, 6/22/99]*
3) *E-mail message regarding "near final" version of Appendix P [Ryan to Sedgwick, 11/22/99]*

We believe that Delivery Order No.14 clearly identifies the types of analyses that are needed to adequately characterize air quality impacts from the alternatives being considered in the EIS. We recommend that the draft EIS be revised to include all of the elements contained in Delivery Order No. 14 to ensure that the public and decision maker have adequate information to judge the significance of the air quality impacts from each alternative. Elements of the Delivery Order that are not presently reflected in Appendix P are as follows:

Sub Task 2a (Environmental setting)

- *location of class I areas or sensitive resources within 100 km of the project area*
- *existing information/data on visibility and regional haze*

Sub Task 2d (Impacts from transportation)

- *assessment of the direct and cumulative impacts of increased mobile source emissions on compliance with air standards*
- *assessment of the impacts from the increased emissions of hazardous air pollutants*
- *development and evaluation of applicable mitigation measures (for transportation-related impacts)*

Sub Task 2e (Impacts from windblown dust)

- *evaluation of impacts, through dispersion modeling, of fugitive emissions from the (dry) river beds. The evaluation shall include, but not necessarily limited to (sic),comparison of modeling results with applicable air standards*
- *development and evaluation of applicable mitigation measures (for windblown fugitive dust emissions)*

Sub Task 2f (Impacts associated with power generation)

- *evaluation of impacts of criteria pollutants and hazardous air pollutants through dispersion modeling*
- *evaluation of impacts to global warming through comparison with national and global budgets of greenhouse gases and tropospheric ozone precursors*
- *evaluation of emissions in the context of meeting the goals of the Clinton administration's policies on climate change, the Climate Change Action Plan, and the United Nations' Framework Convention on Climate Change*
- *development and evaluation of applicable mitigation measures including conservation measures to reduce consumption*

Sub Task 2g (Conformity with State Implementation Plan)

- *evaluate how each project alternative would (or would not) conform with applicable State Implementation Plans for air quality nonattainment and maintenance areas*

Sub Task 2h (Visibility and Regional Haze Impacts)

- *analyze the potential incremental and cumulative impacts of emissions on visibility and air quality related values (AQRV) on areas impacted by the project, including any class I areas within 100 km of the project location(s)*

We find that Section 5.2 of the draft EIS did not complete the air quality analysis and thus, does not completely inform the reader of the implications of the alternatives. The draft EIS indicates that Alternatives 1, 2, and 3 would result in "no (or minor) emission increases" (over current conditions) and therefore these alternatives would result in "no (or minor) short-term or long-term air quality effects." These conclusions do not seem to acknowledge information presented in Table 5.2-2 which shows that current conditions do result in emissions of air pollutants and, if Alternative 1, 2, 3 were to be implemented, those emissions would continue to be emitted (with associated effects). The draft EIS incorrectly concludes that no (or minor) incremental emissions increases (over current conditions) equates to a finding that there are no (or minor) effects. The characterization of effects in an EIS includes three basic components; baseline conditions, changes associated with a given alternative, and other non-project-related contributions. The present characterization of impacts in Section 5.2 is based exclusively on a determination that there are no (or minor) incremental emission increases from Alternatives 1, 2, and 3, and fails to recognize the other elements of impact characterization. Consequently, we recommend that the draft EIS be revised to present a complete, comprehensive characterization of air quality effects from all alternatives.

Natural Gas-Fired Power Plant Emissions

The last paragraph on page 5.2-10 of the draft EIS suggests that emissions (and presumably associated air quality impacts) from new natural gas-fired power plants result in both adverse and unavoidable effects. We were unable to find any information in the draft EIS or Appendix P that supports those conclusions. The draft EIS should be revised to include analyses that support conclusions that air quality impacts from power plants are adverse, including the criteria used to determine/define an adverse impact (e.g., violations of air standards). Additionally, the EIS should include sufficient analyses that demonstrate that emissions from power plants are unavoidable. As presently written, the draft EIS contains no information or analysis related to the potential use of alternative energy sources (e.g., wind-generated power) and/or energy conservation practices that could be implemented to meet part or all of current or future energy demand. We believe that the EIS should investigate and report the alternative energy sources and conservation options available for meeting potential energy needs, provide the public and decision maker with an understanding of how those would be capable of meeting all or some of the current or anticipated demand, and report the potential air quality impacts/benefits associated with their use.

ECONOMIC IMPACTS

Water Quality

As stated earlier, EPA believes the four dams on the lower Snake River contribute to exceedances of water quality standards. As such, the EIS needs to include the costs and benefits of eliminating the dams' contribution to WQS exceedances under each of the alternatives, including the no-action alternative. Otherwise, the EIS should explain why these costs and benefits have been omitted. The draft EIS does not show that cost and benefits of complying with the CWA has been included in the economic analysis.

Inclusion of these costs and benefits would adhere to the economic and environmental principles and guidelines developed by the Water Resources Council (WRC) and which the Corps followed in analyzing the economic impacts in the draft EIS (U.S. Water Resources Council, 1983). In it the WRC guidelines recommend that, "other information *that is required by law or that will have a material bearing on the decision-making process* (emphasis added) should be included in one of the other accounts (EQ, RED, or OSE)[1] or in some appropriate format." (p. I ES-1)

Environmentally Friendly Alternative Power Sources

The draft EIS states (p. I 3-13) that, "It was found that combined cycle (CC) natural gas plants represented the most cost-effective new additions over a wide range of potential plant factors. It was assumed in the Corps and BPA models that all new thermal resources to be built through 2017 would be natural gas-fired combined cycle power plants."

The draft EIS does not explicitly address alternative power generation sources that are more environmentally friendly than combined cycle natural gas plants. It is not apparent from the above quoted statement if more environmentally friendly power sources were analyzed and subsequently omitted from the draft EIS based on cost-effectiveness analysis, or for other reasons. Another concern is that the reference to cost-effective analysis in the draft EIS does not specify what the constraint is, i.e. maximize power, minimize cost, etc. From EPA's perspective, the constraint should be to minimize adverse environmental impacts when comparing the alternative power generation sources, including more friendly power generation.

Also, cost should be considered concurrently with the benefits of achieving a cleaner environment and accordingly, the resulting benefits for having that cleaner technology should also be included in the EIS economic analysis. A related issue is the lack of discussion for analyzing the feasibility of obtaining (some or all) replacement power through the installation of turbines at traditional flood control dams and through conservation.

Transportation

Under Alternative 4, barging will be lost as a transportation mode for produce and products. The EIS needs to discuss the environmental costs and benefits from switching to other modes of transportation. Section 3.3 does not address these possible costs to the environment that could arise due to activities such as increased rail and truck traffic, building and upgrading rail tracks and roads, and making other transportation infrastructure improvements.[2] Any environmental benefits should be accounted for as well.

As an overall comment on economic issues, the public and decision-makers need to be made aware of all probable impacts and associated costs and benefits to the environment. While it may be premature to qualify and quantify many of them at this time, at a minimum the EIS

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[1] EQ = Environmental Quality Account; RED = Regional Economic Development Account; OSE = Other Social Effects.

[2] As an example, the draft EIS states that under Alternative 4 there would be an additional 95,200 truck trips to the Tri-Cities per year, or 45 truck trips per hour. (p. I 3-78) No mention is made of any environmental impacts and associated costs.

needs to discuss them.

Hells Canyon Hydroelectric Complex Relicensing

There are specific recommendations in "Appendix M - Fish and Wildlife Coordination Act Report" for addressing water temperature control and TDG. Though not mentioned, these recommendations have related economic elements. These recommendations are that Idaho Power, FERC, state and federal fisheries agencies, Indian tribes and other participants involved in the relicensing of the Hells Canyon Hydroelectric Complex (HCC) should:

- investigate the installation of a water temperature control system at Brownlee Dam and if feasible, include water temperature control as a requirement of the dam's new license; and
- investigate the opportunities for reducing TDG production (to meet Idaho standards) at the HCC dams , possibly through the installation of increased generating power at the Hells Canyon Dam. (App. M, pp. M-13-1, M13-2, §13.1)

It is not clear to us what is intended by these recommendations. This information is useful to show other ongoing activities that might have positive impacts on the lower Snake River water quality. However, we wish to be sure that this information is not intended to obviate the responsibility of addressing water quality concerns on the lower Snake River that includes the associated costs and benefits that come with attainment of all relevant water quality standards. The reasons are that there is no assurance that these recommendations would be implemented since they are only recommendations and because they fall outside the scope of this EIS.

Non-Direct Environmental Economic Issues

Power - The draft EIS states that, "The analysis of this alternative (4) did not include any hydropower impacts that may occur with changes in irrigation withdrawal from the lower Snake River reservoirs."(p. I ES-6) We do not understand the purpose of this statement and ask that you clarify it.

Alternative Routing - On p. I ES-9, the draft EIS states that for Alternative 4 "... the costs developed in this analysis assume a perfectly competitive market and do not take into account possible increases in rail and truck transportation rates that may occur in the absence of navigation." While the assumption of a perfectly competitive market may be convenient for modeling purposes, this assumption may not be correct. We are particularly concerned with rail transport. Table 3.3-11 (p. I 3-72) indicates there is only one rail line for each origin listed, which implies the existence of a monopoly. Therefore, in the absence of the regulation of rail freight rates, it is likely that freight rates would be higher than is shown in the draft EIS which assumes a perfectly competitive system. At a minimum, addressing higher monopolistic freight rates should be done through a sensitivity analysis.

With respect to the trucking alternative and truck rates, it is not clear how this market would be organized. Based on the Corps's Economic Procedures and Guidelines, "if inland navigation capacity is reduced, competing surface transport modes either possess or would add the capacity necessary to accommodate additional traffic." (p. I 3-60) There could easily be distortions in the market for a number of reasons that would cause only a few or one firm to enter that segment of the market with resultant higher freight rates. At a minimum, this too should be addressed through sensitivity analysis

The draft EIS states that, "The overall method employs the assumption that current and projected levels of exports from the region would continue to be maintained." (p. I 3-61) While it is acknowledged in the draft EIS that transportation prices would increase, what is not addressed is how these increased transportation (freight) costs could directly impact the ongoing viability of lower Snake River regional farms producing and shipping grains for export. That is, higher freight rates for shipping grain to be exported from the lower Snake River region directly translate to higher c.i.f.[3] costs to overseas importers of this grain. In the face of competition and higher freight rates, overseas demand for lower Snake River region grain could be reduced or eliminated.

Consequently, without knowing the price sensitivity of lower Snake River grain export (c.i.f.) prices compared to the competition, we do not know how vulnerable lower Snake River grain exports are in their respective overseas markets and hence, the probability of diminishing demand for lower Snake River region grain exports. The EIS should discuss lower Snake River grain export price sensitivity vis-à-vis the competition, and how reduced overseas demand for lower Snake River grain exports would impact farm viability in the lower Snake River region.

Section 3.3.1 Methodology - Section 3.3.1 states that, "In the case of dam breaching, the change in the cost of transporting products and commodities now shipped from ports on the Snake River is an NED cost, but the loss of revenue and profit by barge companies is not." (p. I 3-57)

By excluding the loss of barge companies' revenues and profit, the decision-maker is not being apprised of the magnitude of adverse impacts on a major transportation sector that would be directly affected by Alternative 4. This information should be included in the economic analysis.

Taxes, Subsidies and Price Level Changes - The draft EIS states that, "The analysis does not take into consideration the effects of taxes or subsidies, which represent transfer payments within the national economy." (p. I 3-62) While taxes and subsidies are considered transfer payments and would not be accounted for in an NED type study, this does not obviate the fact that taxes and subsidies have economic effects in the lower Snake River region. The exclusion of this information, both qualified and quantified, leaves a void in the economic analysis that would be important to a decision-maker.

[3] c.i.f. = cost, insurance, freight. The total cost to the importer for that commodity delivered by vessel to that importer's port, prior to unloading.

§4.2 Salmon (p.I 4-3) - With respect to the four studies used for the benefits transfer analyses, the draft EIS discusses two important issues, namely that:

- no reference was made to threatened or endangered species in the studies. Had this been mentioned, it is likely that values per fish would have been higher; and
- most of the studies used for benefits transfer valued a larger increase in salmon then is expected for the lower Snake River would underestimate the marginal value of the smaller lower Snake River increase.

These two issues indicate that the estimated passive-use value of salmon in all likelihood should be higher, and possibly there would be a substantial increase in these values. At a minimum, it would be prudent for the EIS to include this discussion in the footnotes to Table 4-1 (p. I 4-4), and suggest some quantifiable value or range of values for this increase. Table 4-1 would then provide decision-makers with relevant information on the estimated increases in passive-use values.

Executive Summary of Appendix I - The Executive Summary of Appendix I provides separate tables summarizing the economic effects for each action (e.g. power, recreation and tourism, etc.) for each of the alternatives. This information would be more useful to both decision-makers and the public if it were aggregated into one table. This way total economic effects for each alternative can be viewed side-by-side. These economic effects can be presented with lo-lo, mid-mid and hi-hi estimates so the reader can also see the range of these estimates.

OTHER COMMENTS ON EIS ADEQUACY

Juvenile Survival Estimates for the Alternatives

Under the dam breaching alternative, the draft EIS should explain how the juvenile salmon that are now barged downstream past all eight dams, will migrate past McNary, John Day, The Dalles, and Bonneville Dams. It is hard to judge environmental results if Alternative 4 gets juvenile salmon to McNary Dam while Alternative 1, 2, and 3 gets them past all the dams. The EIS should have discussion which compares the success rate of juvenile salmon making it past the Bonneville Dam for each of the alternatives.

Additionally, Table 5.4-1 describes for Alternative 4 that, "the risk of extinction could be reduced to threshold levels ... if survival below Bonneville Dam is increased by at least 20 percent as a result of this action." It would seem the survival increase needed would be same regardless of alternative. So it is confusing why this is stated only under Alternative 4. If the survival increase needed is not the same for all the alternatives, then explain what is meant by "survival below Bonneville Dam" and how it is calculated. It would then seem logical to give for each of the other alternatives the percentage by which the survival rate needs to increase as well in order to reduce the risk of extinction to threshold levels.

Incidentally, the juvenile fish discussion on pp. 2-6 to 2-9 of the draft EIS implies that river water circulated through the barges and trucks is “maintained”, but does not describe what this means. Is river water circulated through the barges and trucks cooled to more closely approximate the desired water temperatures for juvenile rearing, or is it simply the warm river water taken off the surface of the reservoir that is used? If the latter, what are these water temperatures, and what effect might this have on juvenile salmon condition at the point of release and beyond?

CRI Analysis

The results of the CRI analysis are confusing and we recommend that they be presented differently. First, please provide a clearer explanation of what is meant by NMFS’s proposed *threshold level* for extinction for each of the four stocks, and how this fits into overall recovery goals over time (e.g. through the next 25 years). Then present - by how much - the risk of extinction is estimated to be reduced under each alternative, and some measure of confidence in that estimate. This information could be presented in a bar chart for each of the species of concern. The bar chart could have a bar for each alternative which shows by how much the risk of extinction is reduced under each alternative as compared to the Extinction Risk Threshold. Some discussion of various perspectives on extinction models would be useful, e.g. Mundy 1999.

Currently the draft EIS states that there will be a “slight reduction in the chance of extinction” for alternatives 2 and 3. While for alternative 4, the CRI results shows that “dam breaching is better at reducing extinction risk” than alternatives 1, 2, and 3. The choice of words used makes it unclear if alternative 4 (dam breaching) is significantly better at improving the overall likelihood of salmon stock recovery than either alternative 2 or 3. Nor is it even clear that alternatives 2 and 3 are much better than no-action. The draft EIS should better interpret the results for the reader by clearly stating if the CRI results show significant improvements between the alternatives or if the results of the CRI analysis are unclear and can not be relied upon to make any such conclusions. Also, it would be helpful to include some discussion of the level of confidence in the model, and what the likely consequences on stock viability are, if the model projections prove too optimistic.

Clearly, it is important to convey to the reader that it is unlikely that any of the alternatives alone will be sufficient to advance full recovery of native salmon to the Snake River. Yet it is important to appropriately describe what role the four lower Snake River dams play in the overall recovery efforts that will be needed.

Cumulative Effects

The decline, and in some cases the extinction, of native Snake River salmon is a classic case of cumulative impacts that can generally be grouped as habitat loss, hatchery production, and harvest. However, the draft EIS focuses only on increasing the survival of juvenile salmon through the lower Snake River portion of the salmon life cycle. This concerns us because the public and the decision makers will be weighing the environmental and economic cost of the alternatives against the overall results of salmon recovery. If each cumulative impact is examined in isolation from all the other impacts, no solution will ever be found since there is no single "silver bullet" solution to salmon recovery. We also note that while recovery efforts must be cumulative, so will be the economic costs. Presumably other economic sectors of the region will have to bear more of the economic burden of salmon recovery should an ineffective alternative be selected with this EIS.

Because the focus of this EIS is limited, it is important that the EIS have a thorough cumulative effects analysis. We believe the draft EIS is weak in the discussion of cumulative effects in view of its overall significance and effect on recovery potential. The All-H paper that has been circulated among the stakeholders, should help to provide an expanded discussion in the final EIS of how other efforts are contributing to the recovery of listed salmon stocks. The All-H Paper looks at how habitat, hatcheries, hydropower, and harvesting have all cumulatively taken a toll on salmon. It will offer a menu of possible choices which provides a context for any decision to be made on the lower Snake River dams. Since the draft EIS acknowledges that none of the alternatives by themselves will completely recover the salmon, it is reasonable to assume that other actions will be required in order to save the salmon and fulfill the requirements of the ESA. The EIS should explore those actions.

Further, we believe that the DEIS does not adequately discuss and compare the cumulative and indirect effects (detrimental and beneficial) of the 4 alternatives. We believe that Alternative 4 addresses more of the cumulative and indirect impacts of managing the river system than the other alternatives do. In Appendix M, the U.S. Fish & Wildlife Service referred to the Natural River Drawdown Alternative as "Ecosystem restoration." The EIS should incorporate and describe the perspective provided in this review, that amplifies the overall benefits of the river restoration alternative versus the other three options under consideration. They found that the ...*"Natural river drawdown would allow the restoration of riverine conditions along over 225 km (140 miles) of the lower Snake River. While it would not address all problems with Snake River salmon and steelhead stocks, it would restore near natural or "normative" channel morphology, ecosystem processes, and associated benefits on a landscape scale within the area of the four lower Snake River dams.....It is clear in our assessment that the Natural River Drawdown Alternative would provide many more benefits to fish and wildlife than the other three alternatives in the area of the four lower Snake River dams."* We agree with this finding by the USFWS, and strongly encourage the Corps to consider the benefits to the entire ecosystem in its further analysis, so that the public and decision makers have a reasonably complete frame of reference to guide their decisions.

Environmental Justice

The draft EIS identifies the percentages of minority and low income people, and addresses some of the potential effects from the various proposed alternatives on these populations. However, it does not provide specific information on where these populations reside nor does it provide sufficient information on the potential impacts on the minority and low income communities. As a result, we are unable to determine if all the potential impacts have been properly identified and analyzed, and ascertain if any of the proposed alternatives will result in disproportionate impacts on the minority and low income communities in the proposed study area.

For example, the draft EIS provided information on the economic impacts on the Hispanic population as a result of decreased agricultural opportunities if the dams were breached. However, it did not discuss the economic effects on this specific population as a result of increased residential electricity rates if the dams are breached. Further, the draft EIS did not provide information on whether these impacts will be disproportionately greater on the Hispanic community compared to other communities in the proposed study area. Also, while the draft EIS contains some discussion on cumulative impacts, these discussions were incomplete and nonspecific to the minority and low income communities.

The draft EIS discusses the forums conducted with the 18 communities in the lower Snake River study area and the communities' perceptions of impacts under each proposed alternative. However, it does not provide the reader with the demographics of the community forum participants nor does it inform the reader of the perspectives of the minority and low income communities specifically. As a result, we are unable to determine from the information provided in the draft EIS, whether the minority and low income communities in the study area were afforded the opportunity to participate in the public process in a meaningful way.

Without additional information on the location of the minority and low income communities, the impacts of the proposed actions on these communities, and their participation in the public forums, we are unable to determine whether environmental justice requirements under Executive Order 12898 as part of complying with NEPA, have been met for this project.

Literature cited

Coutant, C. C. 1999. Perspectives on temperature in the Pacific Northwest's Fresh Waters. Report # ORNL/TM-1999/44, prepared by Oak Ridge National Laboratory for EPA Region 10, Seattle, WA.

Department of Interior, Bureau of Reclamation. 1966. Sediment Analysis and Modeling of the River Erosion Alternative. Executive Summary written for the River Ecosystems and Fisheries Restoration Project.

Mundy, P.R. 1999. Status and expected time to extinction for Snake River Spring and Summer Chinook stocks: The Doomsday Clock and Salmon Recovery Index models applied to the Snake River Basin. Contract report prepared for Trout Unlimited, Portland, OR.

National Research Council. 1996. Upstream: salmon and society in the Pacific Northwest. Report to the Committee on Protection and Management of Pacific Northwest Anadromous Salmonids for the National Research Council of the National Academy of Sciences, National Academy Press, Washington, D.C.

Newcombe, C. P. and J. O. T. Jensen. 1996. Channel suspended sediment and fisheries: a synthesis for quantitative assessment of risk and impact. No. Am. J. Fish. Mgmt. 14(4): 693-727.

Poole, G. C. and C. H. Berman. Submitted. Pathways of human influence on water temperature dynamics in stream channels. Environmental Management.

The Independent Scientific Group. 1996. Return to the River: Restoration of salmonid fishes in the Columbia River Ecosystem. Report prepared by the ISG for the NW Power Planning Council, Portland, OR.

The Independent Scientific Group. 1999. Return to the River: Scientific issues in the restoration of salmonid fishes in the Columbia River. Fisheries, 24(3), pp. 10-19.

U.S. Water Resources Council. 1983. *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies*. U.S. GPO. Washington, D.C. March 10, 1983.

Table 1: Comparison of data from Scroll Case and TDG Station for number of days in which water temperature exceeded 68EF.

	Ice Harbor		Lower Granite	
Year	TDG Station	Scroll Case	TDG Station	Scroll Case
1980	56 days	48 days	54 days	39 days
1981	70	55	67	64
1982	51	35	51	46
1983	50	40	47	41
1984	68	60	56	46
1985	65	51	62	49
1986	84	73	54	62
1987	93	81	88	74
1988	60	53	74	85
1989	59	50	45	47
1990	89	70	79	77
1991	76	49	63	55
1992	85	43	58	25
1993	47	0	45	8
1994	98	18	79	32
1995	72	18	47	0
1996	36	41	33	23
1997	60	44	38	26
1998	83	52	86	36
1999	38		40	